(12) **UK Patent Application** (19) **GB** (11) **2 285 702** (13) **A**

(43) Date of A Publication 19.07.1995

(21) Application No 9500752.2

(22) Date of Filing 16.01.1995

(30) Priority Data
(31) 9400593 (32) 14.01.1994 (33) GB

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(51) INT CL⁶
B60R 25/04

(52) UK CL (Edition N)
G4H HTG H1A H13D H14A H14B H14D
U1S S1819 S1820 S2188

(56) Documents Cited
None

(58) Field of Search
UK CL (Edition N) G4H HTG
INT CL⁶ B60R
ONLINE : WPI

(54) **Operating vehicles**

(57) A method of operating a vehicle with a management system including a processor for controlling the vehicle comprises holding a program in encoded form in a first store and on starting the vehicle decoding the program in accordance with a PIN entered and reading it to processor memory. Further programs held in the first store validate the decoded program, and energise alarms if attempts are made to start the vehicle without a PIN, if the decoded program is invalid or in response to outputs from alarm condition sensors. A forgotten or lost PIN can be given to a user using a processor connected to the telephone system and running a database storing user passwords, telephone numbers, vehicle serial numbers, and status flags; which, when an user dials in and gives his password, prompts entry of the serial number which is used determine the PIN, the user then terminates the call and the processor dials the stored telephone number and repeats the PIN (unless the status flag indicates vehicle stolen in which case the authorities are notified and the call traced).
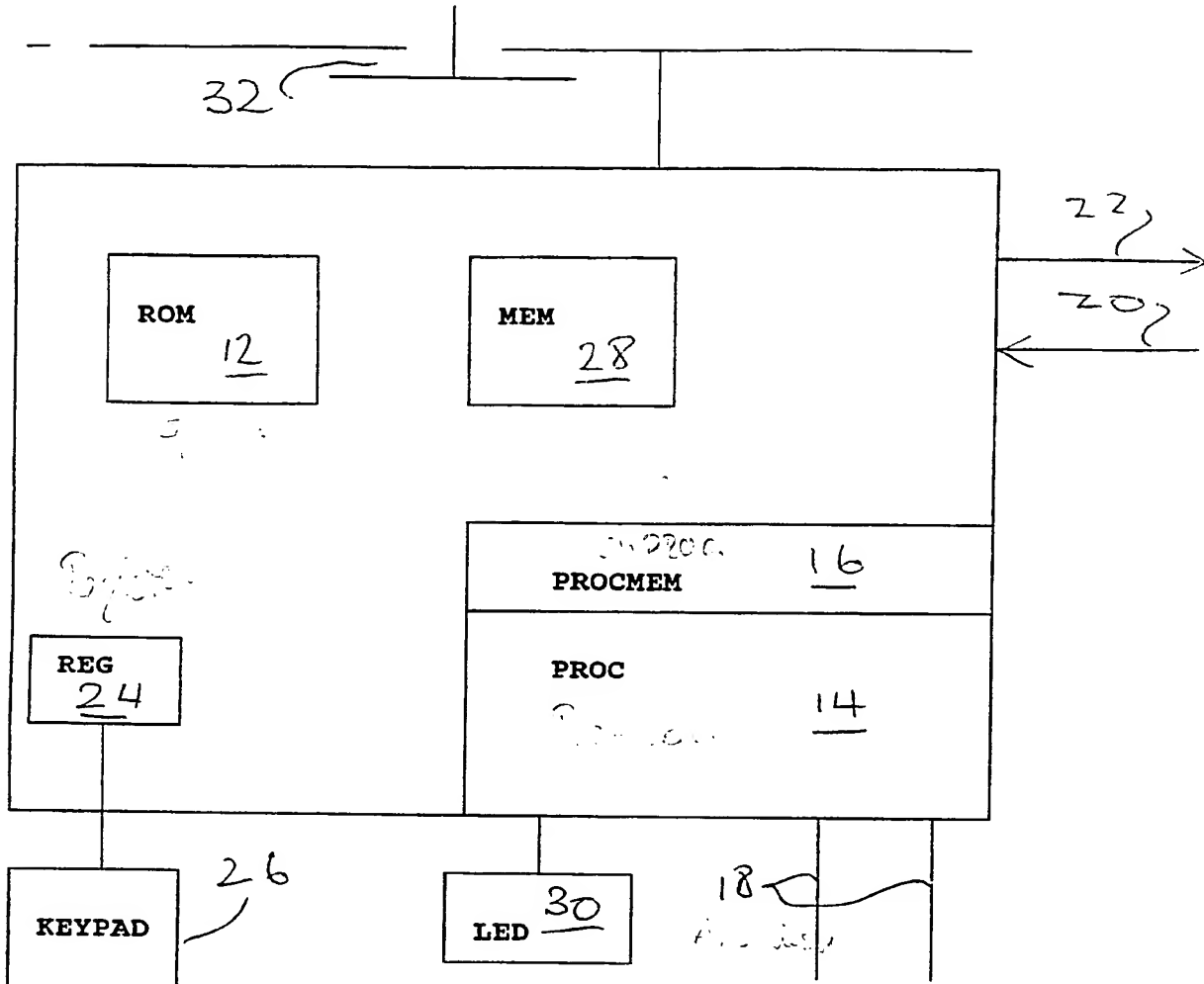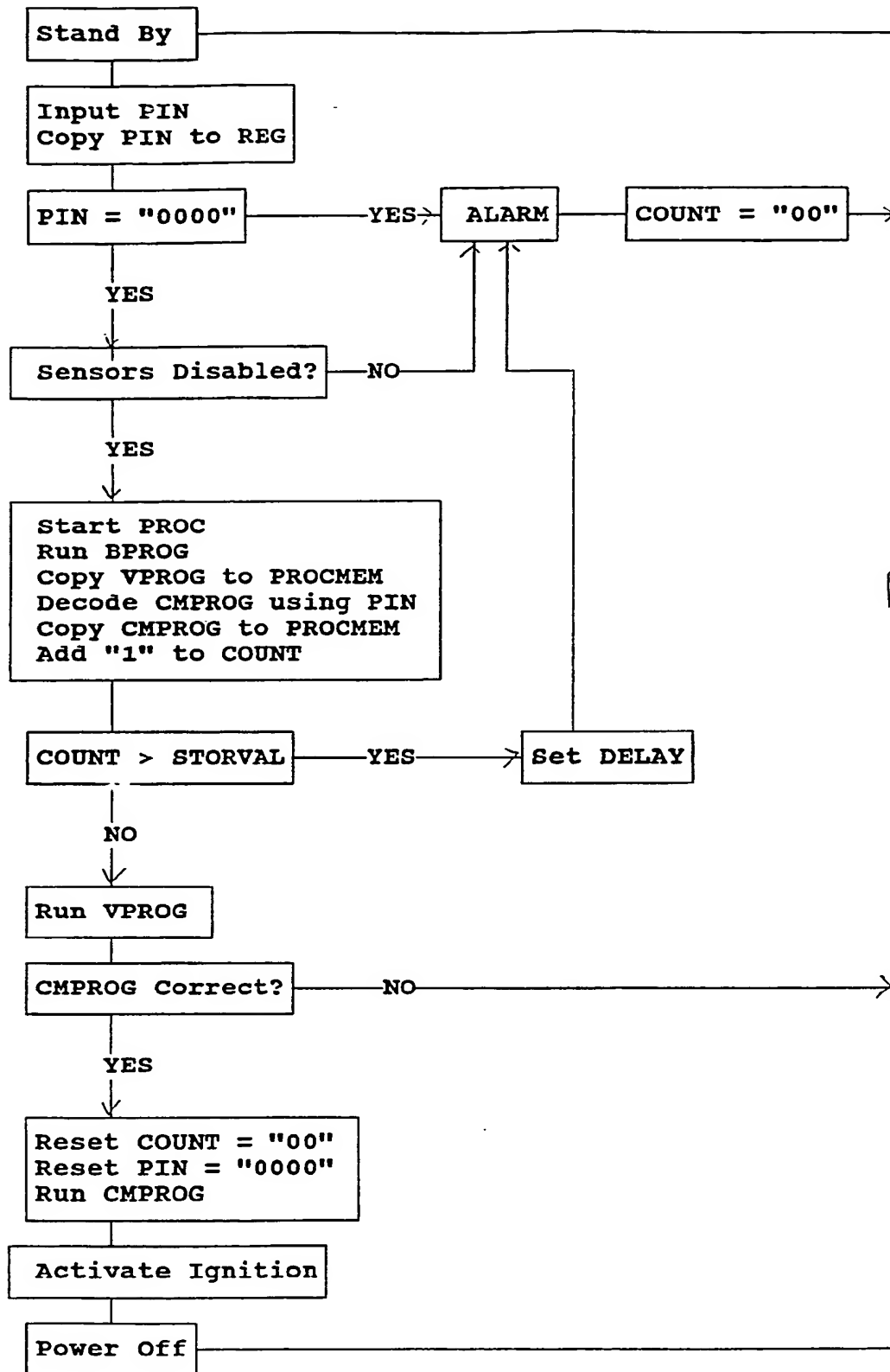
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32

ROM
12

MEM
28

22

20

PROCMEM   16

Systen

REG
24

PROC
14

26

KEYPAD

LED 30

18

Figure 1

```
┌─────────────┐
│  Stand By   │──────────────────────────────────────────┐
└─────────────┘                                           │
      │                                                   │
┌─────────────────┐                                       │
│  Input PIN      │                                       │
│  Copy PIN to REG│                                       │
└─────────────────┘                                       │
      │                                                   │
┌─────────────┐   YES→  ┌────────┐    ┌──────────────┐    │
│ PIN = "0000"│────────→│ ALARM  │───→│ COUNT = "00" │───→│
└─────────────┘         └────────┘    └──────────────┘    │
      │ YES                 ↑  ↑                           │
      ↓                     │  │                           │
┌──────────────────┐  NO    │  │                           │
│ Sensors Disabled?│────────┘  │                           │
└──────────────────┘           │                           │
      │ YES                     │                           │
      ↓                         │                           │
┌──────────────────────────┐    │                          │
│ Start PROC               │    │                          │
│ Run BPROG                │    │                          │
│ Copy VPROG to PROCMEM    │    │                          │
│ Decode CMPROG using PIN  │    │                          │
│ Copy CMPROG to PROCMEM   │    │                          │
│ Add "1" to COUNT         │    │                          │
└──────────────────────────┘    │                          │
      │                          │                          │
┌──────────────────┐  YES  ┌───────────┐                   │
│ COUNT > STORVAL  │──────→│ Set DELAY │                   │
└──────────────────┘       └───────────┘                   │
      │ NO                                                  │
      ↓                                                     │
┌─────────────┐                                             │
│ Run VPROG   │                                             │
└─────────────┘                                             │
      │                                                     │
┌──────────────────┐  NO                                    │
│ CMPROG Correct?  │──────────────────────────────────────→│
└──────────────────┘                                        │
      │ YES                                                 │
      ↓                                                     │
┌──────────────────────┐                                    │
│ Reset COUNT = "00"   │                                    │
│ Reset PIN = "0000"   │                                    │
│ Run CMPROG           │                                    │
└──────────────────────┘                                    │
      │                                                     │
┌──────────────────┐                                        │
│ Activate Ignition│                                        │
└──────────────────┘                                        │
      │                                                     │
┌─────────────┐                                             │
│ Power Off   │─────────────────────────────────────────────┘
└─────────────┘
```

Figure 2

PIN LOOK-UP TABLE

Car Serial No.	PIN No.	Status

56

PHONE CALL-BACK TABLE

Password	Telephone No.

54

EVENT LOG TABLE

Password	Car Serial No.

58

```
          50
         /    \
        /      \
      52        52
```
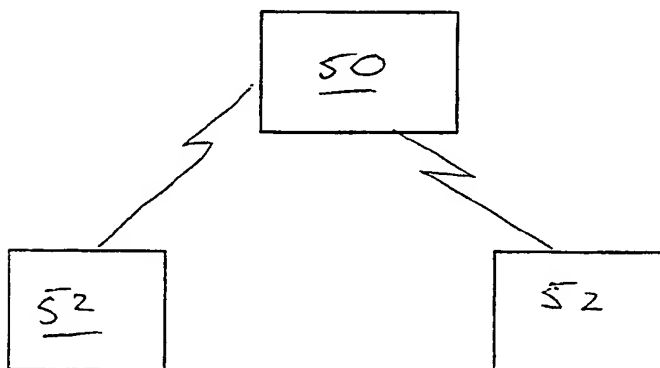
Figure 3

5   OPERATING VEHICLES

10   DESCRIPTION

15   The invention relates to operating vehicles, in particular to methods and apparatus for operating vehicles having vehicle management systems including a processor programmable to effect control of the vehicle's engine.

The methods and apparatus herein described are
20 particularly useful in preventing the theft of vehicles.

The frequency at which vehicles are stolen in this and other countries increases year by year.

Current vehicle theft security systems fall into two classes. The first physically immobilises the vehicle
25 and mechanically prevents movement of the steering wheel, the gear lever, or the operating pedals of the vehicle. The second includes a variety of electrical or electronic

systems which. when armed, sense access to, or motion of, the vehicle and are operable to sound an alarm and, possibly, disable part of the electrical power circuit for the vehicle.

5   Both of these types of system, in widespread use today, appear to be well known to criminals and it is an unfortunate aspect of each of them that they can readily be circumvented by a skilled individual.

An object of the invention is to provide a method 10   and apparatus which will allow a vehicle to be operated only by an authorised user.

In one aspect the invention provides a method of operating a vehicle having an vehicle management system which includes a processor programmable to effect control 15   of the vehicle, the method comprising the steps of holding an vehicle management program for the processor in a permanent, encoded, form in first a store and, when it is desired to operate the vehicle, reading that program from said first store to memory associated with the processor 20   whilst decoding that program in accordance with the content of a second store.

The method may include the step of holding a decoding algorithm permanently in said second store and providing that said second store is a device removable from 25   the vehicle.

The method may further include the step of providing said second store as a register normally set to

ZERO and inputting to that store data which is held therein and used to decode the vehicle management program when it is desired to operate the vehicle.

Desirably, steps are included which provide one or more further programs in said first store for checking and/or validating the decoded program passed to the memory associated with the processor.

Preferably, the method includes the step of providing that the or each said further program energises an alarm if an attempt is made to start the vehicle whilst said register is set to ZERO.

The or each said further program may permit a predetermined plurality of attempts to start the vehicle to be made before an alarm is energised if the vehicle management program in memory associated with the processor is incorrectly decoded.

The or each said further program may also be operable to prevent entry of data to said register for a pre-determined period if the vehicle management program has been incorrectly decoded more than a pre-determined number of times.

Advantageously, said further programs are arranged to prevent operation of said vehicle management program in response to inputs from intruder or other sensors associated with the vehicle.

The or each said further program may energise an alarm if one or more of said sensors associated with the

vehicle is enabled.

A second aspect of the invention provides security system for vehicles having an vehicle management system including a processor programmable to effect control
5   of the vehicle, system comprising a first store in which a vehicle management program is permanently held in encoded form and memory associated with the processor to which that program is read, means being provided allowing the program to be decoded as it is read to the memory associated with
10   the processor.

The means allowing the vehicle management vehicle program to be decoded may comprises a device for holding a decoding algorithm and which is physically separable from the vehicle when the vehicle is not in use, or, preferably,
15   a register to which data is input by a user.

Data may be input to said register, by a locking mechanism actuable by a key held by the authorised user, by an infra red or ultra sonic scanner operable to respond to an infra red or ultra sonic sender actuable by a user, but
20   advantageously, by a keypad by means of which a user may input to said register a sequence of digits.

The system may include allowing a user to input a sequence of digits via said keypad to said register a predetermined number of times before said alarm
25   annunciators are activated.

Desirably delay means are provided preventing entry of a sequence of numbers from said keypad for a

predetermined period after said predetermined plurality of attempts to enter the correct sequence of numbers have been made.

Motion and/or intruder sensors are desirably provided and which are actuable to prevent said vehicle management program being transferred to said memory associated with the processor.

One or more alarm annunciators may be provided which are activated if no data is input to said register.

A third aspect of the invention provides a method of enabling the sequence of numbers usable in a vehicle incorporating a security system as the method comprising coupling a central processor including a data base to the telephone system to enable an authorised user to dial thereinto, loading into that data base information relating to user passwords, user telephone numbers, serial numbers associated with the vehicles for which sequences of numbers have been provided, the sequences of numbers for those vehicles and status flags in respect of those vehicles; the information within the data base being organised into two look-up tables the first of which correlates user passwords with user phone numbers and the second of which correlates car serial numbers with the sequence of numbers which must be input thereto to enable operation of the vehicle management system and said status flags, and into a log table into which information relating to user passwords are collated with car serial numbers.

This method may provide that when an authorised user dials into the central location (at which the database is housed) he is prompted to enter a password and thereafter the serial number associated with the vehicle,

5 a car serial number being then used in the second look-up table to determine the sequence of numbers to be input to the register to enable the vehicle management program to be decoded correctly, the method then further providing that the authorised used is asked to terminate the phone call to

10 enable the central processor to dial the recorded telephone number of the user and repeat to him the sequence of numbers obtained from the look up table.

Desirably, the method further provides that should a status flag in said look-up table indicate the

15 vehicle has been stolen a telephone call is immediately initiated to an authorised authority.

A fourth aspect of the invention provides apparatus for carrying out the above method comprising a processor, memory associated with the processor, pulse

20 and/or tone decoders, modems and the like coupled to the processor in which there is provided a central data base programmed to carry out the method the apparatus further including a voice digitiser.

The above and other aspects, features and

25 advantages of the invention will become apparent from the following description of embodiments of the invention now made with reference to the accompanying drawings in which:-

Figure 1 highly schematically illustrates circuitry embodying and vehicle or vehicle management system embodying the invention,

Figure 2 is a flow diagram illustrating
5   schematically operation of certain functions of the circuitry illustrated in Figure 1, and

Figure 3 illustrates highly schematically a system allowing authorised users a sequence of numbers usable in the system of Figure 1.

10   A car management system embodying the invention comprises an integrated circuit (IC) 10, various functions of which are shown schematically represented in the Figure as various areas, e.g. at 12 there is indicated a permanent memory (ROM) which stores three programs usable in the
15   method and apparatus of the present invention.

The first of these programs is a loader or boot program (BPROG) the second is a car management program (CMPROG) and the third is a validator program (VPROG). Both CMPROG and VPROG are stored in encrypted or encoded
20   form.

IC 10 includes a processor (PROC) 14 having associated with it an erasable read/write memory 16 (PROCMEM) which functions only when power is provided to IC 10. PROC 14 is coupled to components of an vehicle to be
25   managed by via leads 18 and to (passive and/or active) intruder and/or motion sensors (not shown) by leads 20. IC 10 is further coupled to alarm annunciators (e.g. tone

sounders and/or lights - not shown) by leads 22.

IC 10 incorporates a register (REG) 24 normally set to ZERO but operable to receive and store a number sent thereto from a keypad 26; and a memory (MEM) 28 holding a

5 number (STORVAL) setable by a user but in the range of 3 to 7. An LED display 30 is energisable by IC 10 to provide indications to a user.

Power to IC 10 is taken from the electrical power system of the vehicle. Control of the vehicle's ignition

10 system is effected by an ignition switch 32 and the condition of this switch is monitored by IC 10.

The operation of certain functions of the vehicle management system shown in Figure 1 will be explained with reference to Figure 2 which is a flow diagram indicative of

15 the way those functions work.

For a user to start a vehicle having a car management system embodying the invention he must enter a number (PIN) via keypad 26 into REG 24. Thereafter the user must close the ignition switch 32 to activate the

20 management system and enable the vehicle to start. Once ignition switch 32 is closed BPROG held in ROM 12 is operable to check if REG 24 is set to ZERO. If this register is set to ZERO, BPROG causes an output to be passed to lead 22 enabling the alarm annunciators and

25 setting COUNT to ZERO.

If the content of REG 24 is NON-ZERO, BPROG is operable to check that the sensors coupled to IC 10 via

leads 20 are disabled. If the sensors are not disabled **BPROG** is operable to activate the alarm annunciators and set the value of **COUNT** to **ZERO**.

If the sensors are disabled **BPROG** is operable to
5   enable **PROC** 14 and adds **ONE** to a count (**COUNT**) held in that processor. **BPROG** is then operable to cause **CMPROG** to be read from **ROM** 12 to **PROCMEM** 16 whilst, at the same time, decoding **CMPROG** making use of the **PIN** held in **REG** 24.

Once **CMPROG** has been loaded in **PROCMEM** 16 **BPROG**
10   is operable to compare the value of **COUNT** in **PROC** 14 with the value of **STORVAL** held in **MEM** 28.

If **COUNT** is less than or equal to **STORVAL**, **BPROG** is effective to run **VPROG** which is operable to check the integrity of **CMPROG** in **PROCMEM** 16. If **VPROG** determines
15   that **CMPROG** is incorrect (for example because an incorrect **PIN** held in **REG** 24 has been used to decode the program), **BPROG** is enabled to erase all data in **PROCMEM** 16, re-set **REG** 24 to **ZERO** and indicate to a user, via **LED** display 30, that he should open the ignition switch, re-enter the **PIN**
20   via keypad 26 and attempt to re-start the vehicle.

If the value of **COUNT** is greater than that of **STORVAL** held in **MEM** 28 then **BPROG** is operable to activate the alarm annunciators via leads 22 and disable further attempts to energise the management system for a pre-
25   determined period (for example five minutes).

If **CMPROG** is validated by **VPROG** the car management system begins to function, **REG** 24 is reset to

ZERO and COUNT is reset to ZERO.

It will be appreciated that various modifications may be made to the above described arrangement without departing from the invention. Some of the modifications
5   which may be made are as follows:-

Rather than providing that a signal is input to REG 24 the register may be implemented as a device separable from IC 10 - as a "plug in" module - which holds the PIN in ROM.

10   As described the PIN is entered manually via the keypad, but it will be appreciated that the PIN may be entered via an infra-red or ultrasonic scanning device or in any other suitable way.

It will be appreciated that the management system
15   is rendered operable, allowing the vehicle to start, if and only if a PIN has been entered prior to any attempt to energise the engine, only if the sensors for detecting intrusion into or motion of the vehicle have been disabled, only if the correct PIN has been input (enabling proper
20   decoding of the management program) and finally only if the management program is validated.

The provision of a time delay should a number of attempts be made to start the vehicle with an incorrect PIN has the effect of inhibiting electronic cycling of PIN's in
25   an attempt to overcome the protection afforded by the system.

It will be appreciated from the foregoing

description that it is necessary for an authorised user to have or know the **PIN** he must enter for the vehicle is to start.

Clearly if he looses or forgets that number or sequence of digits the will be unable to start the vehicle (despite **STORVAL** giving him a number of attempts to enter the correct number).

Embodiments of the invention provide method and apparatus by which an authorised user may be given his **PIN** should he loose or forget it.

A system for effecting this is highly schematically shown in Figure 3 to comprise a processor 50 incorporating a central database. Processor 50 is located at a central station and is coupled to the telephone network by voice digitisers, pulse and tone decoders and/or modems as indicated generally at 52.

In the database information is organised into three look-up tables. The first indicated schematically at 54 holds information identifying user passwords and collates them with information regarding recorded user telephone numbers; the second, indicated at 56 holds information identifying serial numbers provided for each vehicle with the sequence of digits, or **PIN** usable to activate the management system and with a status flag (normally set to **ZERO** but otherwise operable to cause the system to alert Police); and the third, an EVENT LOG table holding information identifying user passwords with the car

serial numbers and a data logging system.

The PIN recovery system operates in accordance with the schematic flow diagram shown in Figure 4.

Should an authorised user forget or loose his PIN
5   he dials into the system and enters a password (by keying it in on his telephone pad or by using a modem).

The system checks the password and prompts the authorised user to enter (in the same way) the car serial number.

10   The system then looks at table 54 and identifies (after checking the status flag) from the car serial number the appropriate PIN.

If the status flag indicates that the vehicle has been stolen the system automatically generates an alarm
15   call to the authorities and may arranged be activate a trace on the phone line to see from where the system is being accessed.   If the status flag is set ZERO - indicates that it is safe to send the PIN number to the caller - the system prompts the caller to hang up his
20   phone.

The system awaits the caller terminating the call and will then (from LOOK-UP table 55 and the users password) identify the users recorded telephone number. It then automatically dials that number and when the call is
25   answered gives the PIN number by digitised voice to the authorised user.

If the line is engaged the system may be arranged

to wait a few minutes and try once or twice more before it re-sets and awaits the authorised user calling in again.

It is intended that the **PIN** recovery service not be available to the general public - but only to registered

5   users. The security - checked registered users would, it is thought, be limited to certain authorised car dealers, motoring organisations such as the AA and RAC, some Police approved locksmiths and the Police themselves.

In the foregoing description it will be

10   appreciated that the invention provides a method and apparatus which will greatly enhance the security of vehicles fitted with a management system than is presently available.

It is envisaged that the system will be fitted by

15   vehicle manufacturers who will operate the **PIN** recovery service, perhaps at a cost, to those to whom they have sold vehicles.

Other modifications which may be made to the described arrangement may provide that the management

20   system automatically provides, in addition to the sound and/or light annunciation of an intrusion or illegal attempt to start the vehicle, a similar indication by means of a radio link to a remote location.

Various other modifications to the apparatus and

25   method described may be made and which will be apparent to the skilled reader.

CLAIMS

1. A method of operating a vehicle having an vehicle management system which includes a processor programmable to effect control of the vehicle, the method comprising the steps of holding an vehicle management program for the processor in a permanent, encoded, form in first a store and, when it is desired to operate the vehicle, reading that program from said first store to memory associated with the processor whilst decoding that program in accordance with the content of a second store.

2. A method as claimed in Claim 1, including the step of holding a decoding algorithm permanently in said second store and providing that said second store is a device removable from the vehicle.

3. A method as claimed in Claim 1, including the step of providing said second store as a register normally set to ZERO and inputting to that store data which is held therein and used to decode the vehicle management program when it is desired to operate the vehicle.

4. A method as claimed in Claim 3, further including the steps of providing one or more further programs in said first store for checking and/or validating the decoded program passed to the memory associated with the processor.

5. A method as claimed in Claim 4, further including the step of providing that the or each said

further program energises an alarm if an attempt is made to start the vehicle whilst said register is set to ZERO.

6. A method as claimed in Claim 4 or Claim 5, further including the steps of providing that the or each said further program permits a predetermined plurality of attempts to start the vehicle to be made before an alarm is energised if the vehicle management program in memory associated with the processor is incorrectly decoded.

7. A method as claimed in Claim 6, including the step of providing that the or each said further program is operable to prevent entry of data to said register for a pre-determined period if the vehicle management program has been incorrectly decoded more than a pre-determined number of times.

8. A method as claimed in any one of claims 4 to 7, wherein said further programs are arranged to prevent operation of said vehicle management program in response to inputs from intruder or other sensors associated with the vehicle.

9. A method as claimed in Claim 8, further including the step of arranging that the or each said further program energises an alarm if one or more of said sensors associated with the vehicle is enabled.

10. A security system for vehicles having an vehicle management system including a processor programmable to effect control of the vehicle, system comprising a first store in which a vehicle management

program is permanently held in encoded form and memory associated with the processor to which that program is read, means being provided allowing the program to be decoded as it is read to the memory associated with the processor.

11. A system as claimed in Claim 10, wherein the means allowing the vehicle management vehicle program to be decoded comprises a device for holding a decoding algorithm and which is physically separable from the vehicle when the vehicle is not in use.

12. A system as claimed in Claim 10, wherein said means allowing the vehicle management program to be decoded as it is read from said first store comprises a register to which data is input by a user.

13. A system as claimed in Claim 12, further including means enabling data to be input to said register, said data input means comprising a locking mechanism actuable by a key held by the authorised user.

14. A system as claimed in Claim 12, further including means enabling the data to be input to said register by a user, said data input means comprising an infra red or ultra sonic scanner operable to respond to an infra red or ultra sonic sender actuable by a user.

15. A system as claimed in Claim 12, further including means enabling data to be input to said register by a user, said data inputting means comprising a keypad by means of which a user may input to said register a sequence

of digits.

16. A system as claimed in Claim 15, further including means allowing a user to input a sequence of digits via said keypad to said register a predetermined 5 number of times before said alarm annunciators are activated.

17. A system as claimed in Claim 16, further including delay means preventing entry of a sequence of numbers from said keypad for a predetermined period after 10 said predetermined plurality of attempts to enter the correct sequence of numbers have been made.

18. A system as claimed in any one of claims 10 to 17, further including motion and/or intruder sensors actuable to prevent said vehicle management program being 15 transferred to said memory associated with the processor.

19. A system as claimed in Claim 18, further including one or more alarm annunciators which are activated if no data is input to said register.

20. A method of enabling the sequence of numbers 20 usable in a vehicle incorporating a security system as claimed in any one of claims 10 to 19 to be given to an authorised user, the method comprising coupling a central processor including a data base to the telephone system to enable an authorised user to dial thereinto, loading into 25 that data base information relating to user passwords, user telephone numbers, serial numbers associated with the vehicles for which sequences of numbers have been

provided, the sequences of numbers for those vehicles and status flags in respect of those vehicles; the information within the data base being organised into two look-up tables the first of which correlates user passwords with user phone numbers and the second of which correlates car serial numbers with the sequence of numbers which must be input thereto to enable operation of the vehicle management system and said status flags, and into a log table into which information relating to user passwords are collated with car serial numbers.

21. A method as claimed in Claim 20, which provides that when an authorised user dials into the central location (at which the database is housed) he is prompted to enter a password and thereafter the serial number associated with the vehicle, a car serial number being then used in the second look-up table to determine the sequence of numbers to be input to the register to enable the vehicle management program to be decoded correctly, the method then further providing that the authorised used is asked to terminate the phone call to enable the central processor to dial the recorded telephone number of the user and repeat to him the sequence of numbers obtained from the look up table.

22. A method as claimed in Claim 21, wherein it is provided that should a status flag in said look-up table indicate the vehicle has been stolen a telephone call is immediately initiated to an authorised authority.

23. Apparatus for carrying out the method of any one of claims 20 to 22, comprising a processor, memory associated with the processor, pulse and/or tone decoders, modems and the like coupled to the processor in which there is provided a central data base programmed to carry out the method the apparatus further including a voice digitiser.

24. A method of operating a vehicle having a vehicle management system as claimed in Claim 1 and as herein described.

25. Apparatus for use in the vehicle security system as claimed in Claim 10, and substantially as herein described with reference to the accompanying drawings.

26. A method as claimed in Claim 20 and as herein described.

27. Apparatus for carrying out the method of Claim 26, and as described herein in particular with reference to Figure 3.

Patents Act 1977

Examiner's report to the Comptroller under Section 17
(The Search report)

Application number
GB 9500752.2

Relevant Technical Fields	
(i) UK Cl (Ed.N)	G4H (HTG)
(ii) Int Cl (Ed.6)	B60R

Search Examiner
M J DAVIS

Date of completion of Search
14 FEBRUARY 1995

Databases (see below)
(i) UK Patent Office collections of GB, EP, WO and US patent specifications.

(ii) ONLINE: WPI

Documents considered relevant
following a search in respect of
Claims :-
1-19, 24, 25

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Category	Identity of document and relevant passages	Relevant to claim(s)
	NONE	

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